

**COMPETENCY-BASED CURRICULUM  
FOR THE QUALIFICATION OF**

**CERTIFICATE COURSE IN  
ADVANCE MACHINING**

**UNDER**

**CENTRAL TOOL ROOM & TRAINING CENTRE,  
BHUBANESWAR**

**Government of India  
Ministry of MSME**

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## 1. INTRODUCTION

Central Tool Room & Training Centre, Bhubaneswar was established on Technical cooperation between Govt. of Kingdom of Denmark and Government of India during the year 1991. The Technical Cooperation Agreement between the two Govts. was signed on 21<sup>st</sup> April 1989 and the Project Agreement was signed on 2<sup>nd</sup> June 1989.

The Centre is a Govt. of India Society registered under Society Registration Act 1860 on dt. 07.05.1990. The management of affairs of the Society rests with the Governing Council constituted by Govt. of India. The Society has its own Memorandum of Association and Rules and Regulations. The Tool Room has been set up to meet the growing demand of tools in the Country and producing skilled man power for the industries. CTTC, Bhubaneswar is on the way of achieving its set goal and within its 24 years of existence could stand as a premier Tool Room and Training Centre in India. The Centre is not confined within the Bhubaneswar region but has expanded beyond by setting up extension Centers are Rayagada (KBK area) and Kalinga Nagar. It has set the bench mark among all the Tool Rooms and Training Centers under the Ministry of MSME for its quality training programmes in the field of tool Design and Manufacturing, precision components manufacturing in Automobile and Aerospace industries, CAD/CAE/ CAM/CNC technology/ Hardware and Networking/ VLSI/ Industrial Automation and Robotics/ Structural Design and Analysis in different level of disciplines. In pursuit of excellence the Tool Room has been awarded with ISO 9001:2008, AS9100C, ISO 14001:2004, ISO 29990:2010, ISO 50001:2011 and OHSAS 18001:2007 certifications. The Tool Room has achieved self-sufficiency in the year 2003 with regard to recurring expenditure and also covering depreciation since 2008.

**Objectives:** The main objectives of the Tool Room are as follows:

As per the DPR the Tool Room was to be set up mainly for upgradation of technology in Small Scale sector as the industries cannot afford to have their own Tool Rooms and provide Skill Development training to the workmen. The defined objectives of the Tool Room are as follows:

- To develop production facilities of moulds, jigs, fixtures, gauges & other sophisticated tools and provide common facility centre to MSMEs.
- To train manpower in the field of tool making & other allied engineering trades both for the fresher & for personnel already engaged in the field.
- To provide consultancy primarily for Micro, Small & Medium Enterprises in the field of tool engineering aimed at improvement of quality and productivity.

**Training:** One of the main purposes of establishing the Tool Room was to provide skilled man power to the industries and conduct skill upgradation training programmes for the personnel already engaged in MSMEs. CTTC Bhubaneswar is Conducting AICTE Approved courses such as 4 year diploma in Tool & Die making , 3 Year Diploma in Mechatronics and NCVT Approved ITI Machinist course. Now the Tool Room is conducting both long and short term, sponsored

programmes and International training programmes. Training is now the thrust area and Govt. of India is giving more emphasis in skill development. The Centre is also planning to conduct more skill development programmes in future to meet the growing demand. The fields in which the Tool Room is conducting the training programmes are as follows:

1. Tool Engineering
2. CAD/CAM/CAE/CNC/Industrial Automation and Robotics
3. Mechatronics
4. Structural Design and Analysis
5. VLSI and Embedded system
6. Tailor made courses for foreign nationals/ Ind. & Institute professionals

**Extension Centers** : To meet the growing demand in skill development the Centre is not confined within the Bhubaneswar region but has started its Extension centres at Rayagada (KBK area) and at Kalinga Nagar in the district of Jajpur, Odisha, City Centre at Satya Nagar, Bhubaneswar. Different long and short term training programmes in the field of tool engineering and allied subjects are being conducted.

**Production**: One of the mandate for establishment of CTTC, Bhubaneswar was to manufacture dies, moulds, press tools and provide common facility to the MSMEs. The Centre had started production at the end of 1996 and since then engaged in manufacturing tools and dies for MSMEs and other industries. CTTC, Bhubaneswar is also engaged in manufacturing sophisticated components for the Automobile and Aerospace industries. The Centre has earned a brand image for high precision machining and critical tool production to bag appreciation from ISRO for outstanding contribution in realizing critical flight hardware for the Mangalyaan Mission. CTTC is supplying high precision components/ sub-assemblies to M/s ISRO, LPSC, Bangalore, M/s ISRO, IISU, Thiruvanthapuram, M/s ADA, Bangalore, HAL, Bangalore and DRDO Hyderabad etc. CTTC, Bhubaneswar has been extending its common facility Centre in the production for benefit of the MSME sector of the State and adjoining States. Revenue collected during the year 2015-16 from Production Department was Rs. 10.33 crores.

**Consultancy**: Since inception CTTC, Bhubaneswar has been continuously providing consultancy services to the MSMEs in Odisha and adjoining States for improvement of their quality and productivity. Consultancy services is extended to MSMEs and clusters on various National Manufacturing Competitiveness Programme components of DC (MSME) such as QMS, QTT, Design clinic, Lean Manufacturing, IPR, Mini Tool Rooms/ EFC Project review and project report preparation etc. The experts of CTTC, Bhubaneswar visit to MSMEs and conduct several capacity building programmes on the shop floor for MSMEs' workmen, supervisors to promote quality and to improve safety and moral of the employees. It is also conducting several open house public programmes on Quality Management Standards, ISO standards, TQM, TPM, Lean six sigma Green Belt Certification programmes etc. It has created a good demand for unemployed youth and professionals working in both industries and Academic institution/ Universities under Management skill development programmes. The Consultancy services of the Centre has provided service to **1390** MSMEs during the year 2015-16.

### **About NSQF:**

The National Skills Qualification Framework (NSQF), published in the Gazette of India on 27th December, 2013, is a national framework that aims to integrate general and vocational streams of education and training. The main goal of the NSQF is to focus on competency-based qualifications, which in turn facilitate and enhance transparency, both within and between general and vocational streams. The National Skill Development Agency (NSDA) under the Ministry is responsible for anchoring and implementation of the Framework, by bringing together the key stakeholders through the National Skill Qualifications Committee (NSQC).

The competency-based framework organizes qualifications into ten levels, with the entry level being 1, and the highest level being 10. Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are (1) Process, (2) Professional knowledge, (3) Professional skill, (4) core skill, and (5) Responsibility. The paradigm shift from learning focused on inputs to an outcome/competency-based education would help in the Recognition of Prior Learning (RPL), and simultaneously enable the alignment of the Indian qualifications with international ones. Government funding is expected to be on a preferential basis for NSQF compliant courses. The NSQF notification provides a Qualification Register, which is the official national database of all qualifications aligned to NSQF levels. Through this Register, learners can expect access to all NSQF compliant qualifications.

### **Introduction to the qualification:**

The course is design to train ITI pass outs (Fitter) in the areas of advance machining. The training will be exposed to basic turning, milling, grinding, fitting and also in the area of electro discharge machining (EDM), wire cut EDM, computer fundamentals, AutoCAD, CNC turning and CNC milling, inspection, heat treatment etc. Trainees will be put to extensive and vigorous practical training to improve their skill. After completion of the course trainees will be able to operate all conventional machines and CNC turning & milling. Trainees will also trained on the computers.

## 2. GENERAL INFORMATION

	<b>CERTIFICATE COURSE IN ADVANCE MACHINING</b>
1 Qualification	
2 NSQF Level	Level- 5
3 Duration of the course/qualification	01 Year
4 Entry Qualification	ITI fitter

Distribution of notional training hours of the training per week:

### FIRST SEMESTER

Total hours /week	Professional Skill	Professional Knowledge	Engineering drawing	Metrology	Communication Skill
40 Hours	24Hours	6Hours	6Hours	2 Hours	2 Hours

Distribution of notional training hours of the training per week (1 – 20 week)

### SECOND SEMESTER

Total hours /week	Professional Skill	Professional Knowledge	Engineering drawing	Material Technology	Project work
40 Hours	24Hours	6Hours	5Hours	3 Hours	2 Hours

21 - 24 week - In plant training/Project work

### 3. COURSE STRUCTURE

Name of the Qualification: **Certificate Course in Advance Machining.**

Total duration of the course: One Years (Two semesters)

Training duration details:

#### SEMESTER – I

<b>Course Elements</b>	<b>Hourly Distribution</b>
Professional Skills	576hrs
Professional Knowledge	144hrs
Engineering drawing	120hrs
Metrology	80hrs
Communication Skill	40hrs
<b>TOTAL</b>	<b>960 hrs.</b>

#### SEMESTER – II

<b>Course Elements</b>	<b>Hourly Distribution</b>
Professional Skills	480hrs
Professional Knowledge	120hrs
Engineering drawing	120hrs
Material Technology	40hrs
Project work/ In plant Training	200hrs
<b>TOTAL</b>	<b>960 hrs.</b>

## **4. JOB ROLES**

### **4.1 Brief description**

**Certificate course in advance machining (CCAM)** is designed to impart skill sets to prepare mechanical components, equipment, etc. from sketches, notes, and data. Trainees also create objects on Drawing Space using toolbars, commands and menus in CAD application software for purposes of manufacturing. They can manufacture component by using basic turning, milling, grinding, CNC turning & CNC milling machines according to drawing dimension and tolerance and also in the area of electro discharge machining (EDM) wire cut EDM.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

### **4.2 NOS Mapping:**

- 1. CSC/ N 1335 (Use basic health and safety practices at the workplace)**
- 2. CSC/ N 1336 (Work effectively with others)**



## 5. NSQF LEVEL COMPLIANCE

The Broad Learning outcomes of **Certificate Course in Advance Machining** match with the Level descriptor at Level 5.

The NSQF Level 5 descriptors given below:

<b>LEVEL</b>	<b>Process required</b>	<b>Professional knowledge</b>	<b>Professional skill</b>	<b>Core skill</b>	<b>Responsibility</b>
Level 5	Job that requires well developed skill, with clear choice of procedures in familiar context.	Knowledge of facts, principles, processes and general concepts, in a field of work or study.	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information.	Desired mathematical skill; understanding of social, political; and some skill of collecting and organising information, communication.	Responsibility for own work and learning and some responsibility for others' works and learning.

## **6. GENERAL TRAINING PLAN, EXAMINATION & PASS REGULATION**

### **General Training Plan**

The knowledge and skill components as stated in the section for 'learning outcomes' are to be imparted in accordance with the instructions in respect of the content and time structure.

### **Assessment**

The assessment for the semester-based qualification is carried out by conducting formative assessments, and end-of-semester examinations, as per the guidelines given in the Curriculum. Theory examinations are conducted in production technology, Engineering metrology, and Material technology, Engineering Drawing, Communication. Practical examinations are conducted by the CTTC. The details of the examination and assessment standard are in a latter section. CTTC prepares the question papers for the Practical. Candidates are to demonstrate that they can:

1. Read & interpret technical parameters/documentation, plan and organize work processes, and identify necessary materials and tools,
2. Perform a task/job with due consideration to safety rules, accident prevention regulations and environmental protection stipulations,
3. Apply Professional Knowledge, Core Skills, and Entrepreneurship development skill while performing the task/job.
4. Check the task/job as per the drawing for proper functioning, and identify and rectify errors in the job, if any.
5. Document the technical parameters related to the task/job.

### **Pass regulation**

Minimum Marks to pass practical exam – 60%

Minimum Marks to pass final exam – 70%

Minimum Marks to pass viva / oral exam – 60%

Minimum Marks to pass Project report and presentation exam – 80%

## **7. LEARNING OUTCOMES**

The following are minimum broad learning outcomes after completion of the Certificate Course in Advance machining course of 1-years duration:

### **A. GENERIC OUTCOMES**

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.
3. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
4. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
5. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
6. Explain and use engineering drawing in the field of study including sectioning, dimensioning and geometrical feature.
7. Explain and use engineering metrology in manufacturing.
8. Explain and use of various engineering materials in the field of manufacturing.

### **B. SPECIFIC OUTCOMES**

#### **SEMESTER - I**

9. Demonstrate and use of tools, equipment and machine which applied it in day to day work in production technology.
10. Demonstrate and use of lathe, milling, drilling machines and operations
11. Create the object by using AutoCAD

#### **SEMESTER – II**

12. Demonstrate and operate CNC lathe machine independently.
13. Demonstrate and operate CNC milling machine independently.
14. Demonstrate and operate the Non-conventional machine like EDM & wire EDM

## 8. ASSESSABLE OUTCOMES WITH ASSESSMENT CRITERIA

**Note:**

1. The training shall be conducted as per the syllabus.
2. The trainee shall demonstrate the competencies that are defined below in the assessable outcomes highlighted below.
3. The trainee shall be assessed for his/her achievement levels in all the assessable outcomes on the basis of the formative assessment, Theory & Practical examinations, observation, and viva-voce.
4. The trainee shall be assessed for his/her achievement levels in all the assessable outcomes of the Engineering drawing, engineering metrology, communication, material technology and entrepreneurship development on the basis of Theory Examinations, and for his/her ability to apply the concepts in Practical.
5. The assessable outcomes and assessment criteria will serve as a set of guidelines for Trainers, Paper setters, Moderators, and Assessors.

**Assessable outcomes along with assessment criteria to be achieved after each semester and completion of qualification:**

**Generic assessable outcomes:**

ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
1. Recognize & comply safe working practices, environment regulation and housekeeping.	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements and according to site policy. 1.2 Recognize and report all unsafe situations according to site policy. 1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures 1.4 Identify, handle and store / dispose of dangerous goods and substances according to site policy and procedures following safety regulations and requirements. 1.5 Identify and observe site policies and procedures in regard to illness or accident. 1.6 Identify safety alarms accurately. 1.7 Report supervisor/ Competent of authority in the event of accident or sickness of any staff and

	record accident details correctly according to site accident/injury procedures.
	<p>1.8 Identify and observe site evacuation procedures according to site policy.</p> <p>1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment.</p> <p>1.10 Identify basic first aid and use them under different circumstances.</p> <p>1.11 Identify different fire extinguisher and use the same as per requirement.</p> <p>1.12 Identify environmental pollution &amp; contribute to the avoidance of instances of environmental pollution.</p> <p>1.13 Deploy environmental protection legislation &amp; regulations</p> <p>1.14 Take opportunities to use energy and materials in an environmentally friendly manner</p> <p>1.15 Avoid waste and dispose waste as per procedure</p> <p>1.16 Recognize different components of 5S and apply the same in the working environment.</p>
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.	<p>2.1 Obtain sources of information and recognize information.</p> <p>2.2 Use and draw up technical drawings and documents.</p> <p>2.3 Use documents and technical regulations and occupationally related provisions.</p> <p>2.4 Conduct appropriate and target oriented discussions with higher authority and within the team.</p> <p>2.5 Present facts and circumstances, possible solutions &amp; use English special terminology.</p> <p>2.6 Resolve disputes within the team.</p> <p>2.7 Conduct written communication.</p>
3. Explain engineering drawing in the	3.1 Construct different geometrical features like

field of manufacturing	<p>triangle, circle, ellipse, etc.</p> <p>3.2 Draw the orthographic projection by seeing isometric fig.</p> <p>3.3 Draw the isometric projection by seeing orthographic fig.</p> <p>3.4 Draw the sectional views by seeing isometric fig.</p> <p>3.5 Mention geometrical features in part detail drawing</p>
4. Explain the use of engineering metrology in manufacturing	<p>4.1 Demonstrate the use of various measuring instrument</p> <p>4.2 Find out the least count of various measuring instrument</p> <p>4.3 Measure the linear dimension of work piece using different measuring instrument like Vernier caliper, Micrometer etc.</p> <p>4.4 Measured the angle by using angle measuring instruments like Vernier bevel protractor etc.</p> <p>4.5 Demonstrate various type of comparator like dial indicator and its use.</p> <p>4.6 Find out the maximum and minimum metal limit by using deviation and tolerance table.</p>
5. Explain the use of various engineering materials in the field of manufacturing	<p>5.1 Identify the metal by various properties like mechanical, physical, chemical, magnetic, etc.</p> <p>5.2 Explain metal extraction process like ferrous, copper, aluminum, zinc etc.</p> <p>5.3 Draw and explain iron-carbon diagram</p> <p>5.4 Draw and explain the time temperature transformation diagram</p> <p>5.5 Explain different microstructure of steel.</p> <p>5.6 Explain different heat treatment process.</p>

**Specific assessable outcomes:**

**Semester-I**

ASSESSABLE OUTCOME	ASSESSMENT CRITERIA
6. Understand and demonstrate basic knowledge on tools, equipment and machine which applied it in day to day work in production technology.	6.1 Do filing operation of using different types of file by identifying the different types of file.
	6.2 Do marking by using marking equipment like scribe, divider, Vernier height gauge, 'v' block, surface plate, etc.
	6.3 Check flatness and perpendicularity by using surface plate, angle plate try square.
7. Understand and demonstrate the lathe, milling, drilling, Grinding machines and operations.	7.1 Do the facing and turning operation on Lathe machine
	7.2 Calculate rpm of spindle for each operation
	7.3 Do the center drilling, drilling and threading operations under supervision.
	7.4 Do grooving, knurling operation under supervision.
	7.5 Do the taper turning operations by various methods
	7.6 Do the milling operations and maintain dimensions of all parts.
	7.7 Do the slotting operation on milling machine.
	7.8 Do practice and maintain dimension by Grinding Machine.
8. Create the drawing and models by using AutoCAD	8.1 Draw 2D drafting by using toolbars
	8.2 Identify and apply Line, Break, Erase, Undo, Trim, Offset, Fillet, Chamfer, Move, Copy, Array, Insert Block, Make Block, Scale, Rotate, Hatch Commands with Absolute Co-ordinate system, Polar Co-ordinate System and Relative Co-ordinate System
	8.3 Provide title and dimension on object drawing.
	8.4 Create 3D object by using Extrude, Revolve command, subtract, union.
	8.5 Conversion isometric object into orthographic view.
	8.6 Do the assembly drawing

## Semester-II

ASSESSABLE OUTCOME	ASSESSMENT CRITERIA
9. Demonstrate and operate CNC lathe machine independently . . . . .	9.1 Write the program by using G and M code.
	9.2 Do the homing by various method.
	9.3 Set the datum of job with respect to machine.
	9.4 Check simulation of program.
	9.5 Check the program in safety height.
	9.6 Solve the trouble shooting during machining
	9.7 Do the facing, turning operations
	9.8 Do the threading operation
	9.9 Do the drilling and boring operations
	9.10 Do the grooving operation
10. Demonstrate and operate CNC milling machine independently . . . . .	10.1 Write the program by using G and M code.
	10.2 Do the homing by various method.
	10.3 Set the datum of job with respect to machine.
	10.4 Check simulation of program.
	10.5 Check the program in safety height.
	10.6 Solve the trouble shooting during machining
	10.7 Do the facing operations
	10.8 Do the drilling and reaming operation
11. Demonstrate and operate the non-conventional machining. . . . .	11.1 Do the datum setting
	11.2 Do the current, voltage, and spark time setting in machine
	11.3 Check the di-electric medium
	11.4 Do the electrode mounting in the machine
	11.5 Write the program



## 9. SYLLABUS CONTENT WITH TIME STRUCTURE

### SYLLABUS FOR THE CERTIFICATE COURSE IN ADVANCE MACHINING

#### 9.1 Syllabus Content for Professional Skill and Knowledge.

**First Semester** (Semester Code No. **CCAM - 01**)

Duration: Six Months

#### Learning Objectives (1<sup>st</sup> Semester)

1. Apply safe working practices.
2. Comply environment regulation and housekeeping.
3. Interpret & use Company terminology and technical communication.
4. Use the hand tool properly
5. Use the AutoCAD drawing for manufacturing
6. Operate the machine like, Lathe, Milling and grinding machine.

Subject	Week No.	Professional Skill	Professional Knowledge
Production Technology	1	Importance of training, List of tools & Machinery used in the trade. Health & Safety: Introduction to safety equipment and their uses. Introduction of first aid, operation of Electrical mains. Occupational Safety & Health Importance of housekeeping & good shop floor practices. Health, Safety and Environment guidelines, legislations & regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction, Personal protective Equipment (PPE):- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. Use of Fire extinguishers.	Importance of safety and general precautions observed in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. Soft Skills: its importance and Job area after completion of training. Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies e.g.; power failure, fire, and system failure.

2	Mark the flat and cylindrical job using marking tool, Use hand tool for various operations, Use different type of vice for hold the job	Hand tools - scriber, divider, punch, surface plate, 'v' blocks, angle plate, hammer, screw driver, spanner, pliers, etc. Holding tools - vice, 'c' clamp, tool maker vice.
3.	Remove the material by using hand cutting tools	Hand tools-file, chisel, scraper, hacksaw etc.
4.	Do the drilling operations of various diameters and finish it with reaming.	Cutting tools-Drill bits, reamer,
5.	Do inside and outside thread by using tap and dies	Cutting tools and operations - hand taps, thread dies
6.	Use the different screw, nut, bolt stud etc. in assembly.	Screw threads fasteners
7.	Open the power transmission drive of machine and reset it.	Transmission power- belt drive, chain drive, gear drive, clutch, cam, etc.
8.	Change the coolant from machine tank and replace with new coolant by mixing water and cutting oil and also put lubricant oil in sliding parts of machine	Lubricant, coolant and general maintenance
9.	Prepare the fixture for holding different complicated job.	Jigs and fixtures, types of jig and fixture, drill jig, leaf jig, etc.
10.	Identify and demonstrate different parts of lathe.	Lathe, types, attachment and accessories.
11.	Grind the knife tool by pedestal grinding machine	Right hand knife tool nomenclature.
12.	perform various operations in lathe like turning , facing, grooving, threading, etc.	lathe operation
13 - 14	Identify and use of various milling tools for the particular operation like slotting, pocketing.	Multi point cutting tool-milling tools.
15.	Operate milling machine and perform various milling operation	Milling machine, types of milling, lathe attachment, milling accessories, milling operation, etc.

	16.	Balance and set the grinding wheel in grinding machine spindle with respect to work material.	Grinding wheel specification
	17.	Operate the grinding machine and check surface finish	Grinding machine, types of grinding, cylindrical grinding, grinding operation, etc.
	18.	Do the hole by drilling operation	Drilling machine
	19-20	Do the gear by using Indexing	Special machines and operations i.e., Indexing
Auto CAD	21	Exercise using Line, Break, Erase, Undo commands with Absolute Co-ordinate system, Polar Coordinate System and Relative Co-ordinate System. Exercise using Trim, Offset, Fillet, Chamfer, Move, Copy, Array, Insert Block, Make Block, Scale, Rotate and Hatch Commands.	Create Line, Break, Erase, Undo Trim, Offset, Fillet, Chamfer, Arc and Circle commands. Move, Copy, Array, Insert Block, Make Block, Scale, Rotate, Hatch Commands.
	22	Practice using Creating templates, Inserting drawings, Layers and Modify Layers. Dimensioning drawings. Creating styles in dimensioning. Modifying styles in dimensioning. Practice the orthographic view by using tolerance and GD&T symbols	Creating templates, Inserting drawings, Layers Modify Layers. Dimensioning, Creating styles in dimensioning. Modifying styles in dimensioning. Tolerances and Tolerance control frame with GD&T symbols, Datum to drawings
	23	Create the assembly drawing part details Drawing practice using 3D primitives, Extrude, Revolve command, subtract, union, Drawing practice using revolve, ruled, tabulated, edge etc. Save the drawing by various extension file.	Assemble drawing and part details. Introduction to 3D, 3D primitives Extrude, Revolve command, Surface Modeling – Revolve, Ruled, Tabulated, Edge etc. File Extension like *.dwg, *.dwt, *.dxf etc., Export/Import of files from other CAD software's
	24	Practice the various animation 3D drawing by using User co-ordinate systems. Plotting, Print preview	Creation of Script files for animation of Clock, Piston and Cylinder, 3D fan etc. Motion path animation for Dining Table with chairs and Carpet Setting User co-ordinate Systems, Rotating, Plotting,

		Print preview
	25	<b>EXAMINATION</b>

## Second Semester (Semester Code No. CCAM- 02)

Duration: Six Months

### Learning Objectives (2<sup>nd</sup> Semester)

1. write the CNC program
2. Operate the CNC lathe
3. Operate the EDM, wire EDM machine
4. Select proper cutting tool according to the drawing profile
5. Set cutting parameter
6. Produce intricate and complicated component by using the machine
7. Explain different type of tool material

Subject	Week No.	Practical	Theory
CNC Lathe	1.	Identify CNC lathe machine parts, Move the machine in jog and MPG mode. Do the homing of machine by various mode. Do the jaw settings in CNC Lathe.	Introduction to CNC turning, mode of controller, Homing or reference point, G and M code. Mechanism of machine chuck clamp and de-clamp in CNC Lathe.
	2.	Selection of tooling & practice. Set the parameter. Practice the offset setting in CNC Lathe.	Tool holder & Carbide cutting tool, specification, signature and nomenclatures, Tool parameter, cutting speed, feed, depth of cut, Offset setting in CNC Lathe.
	3.	Check the simulation and solve the trouble shooting. Do the facing, turning, step turning operation in CNC Lathe.	Program writing, simulation of Facing program, plain turning programs, Plain turning, step turning in CNC Lathe.
	4.	Do the taper turning, turning operation and give chamfer in sharp edges in CNC Lathe.	Tapper turning, Radius, fillet program in CNC Lathe.
	5.	Do the drilling, reaming, boring, step boring, grooving, threading operations in CNC Lathe.	Drilling, Reaming, Boring, step boring, grooving, Threading program in CNC Lathe.
CNC Milling	6.	Identify CNC milling machine parts Move the machine in jog and MPG mode. Do the homing of machine by various mode.	Introduction to CNC milling, mode of controller, Homing or reference point, G and M code. Mechanism of automatic tool changer machine

			chuck clamp and de clamp
	7.	Selection of tooling & practice. Set the parameter in CNC Milling.	Tool holder & Carbide cutting tool, specification, signature and nomenclatures, Tool parameter, cutting speed, feed, depth of cut in CNC Milling.
	8.	Write a program and check compensation in CNC Milling.	Cutter compensation in CNC Milling.
	9.	Practice datum setting in various coordinate in CNC Milling.	Process of Datum setting in CNC Milling.
	10.	Check the simulation and solve the trouble shooting in CNC Milling.	Programming and check the program in simulation.
	11.	Do the facing, pocketing, contour operation	Facing program, Pocketing program, contour program
	12.	Do the drilling, reaming operation	Drilling, Reaming program
	13.	Do the multiple operations	Multiple program
	14.	Send the CAM data to CNC machine	Running the machine DNC mode
	15.	Job practice	assignment
Non-conventional machining	16.	Identify and demonstrate part of machine	Introduction to Non-conventional machining(LBM, EDM, AJM)
	17	Select proper Electrode Material and di-electric medium for machining operations.	Main components of EDM- Mechanical Section , Dielectric Fluid System and pulse generator, Properties of tool, Properties of Dielectric Fluid, Controller mechanism of X, Y & Z axis in Die sinking EDM, Servo Mechanism of spark gap Mechanism of X, Y & U,V axis in WEDM
	18 - 19	Checking simulation of program and execute the same to see the output.	Programming, simulation and execution in Machine
	20.	Check the proper value of overcut and metal removal rate after machining	Calculation of overcut, Calculation of metal removal rate, Calculation of tool wear ratio
	21-24	<b>INPLANT TRAINING</b>	
	25	<b>EXAMINATION</b>	

## 9.2 Syllabus Content of Core Skills

## First Semester (Semester Code No. CCAM - 01)

Duration: Six Months

### Learning Objectives (1<sup>st</sup> Semester)

1. Interpret & use Company terminology and technical communication.
2. Making geometrical figures using drawing instruments.
3. Free hand sketching of machine parts.
4. Views showing Orthographic, Isometric and Oblique projection.

SL.NO	ENGINEERING DRAWING
1.	Line types, Thickness, Drawing sheet size, scale etc.,
2.	Orthographic Projection, 1st angle projection method
3.	Orthographic Projection, 3rd angle projection method
4.	Missing views, Auxiliary views- Projection methods
5.	Geometrical Dimensioning- Rules & Methods- types- aligned and Unidirectional
6.	Limits, Fits & Tolerances Study and usage of Tolerance charts, Hole basis and shaft basis system
7.	Method of indication of Dimensional Tolerances, Types of Geometrical characteristic symbols

### Learning Objectives (1<sup>st</sup> Semester)

1. Interpret & use precision and non-precision instrument
2. Use of gauges and comparator
3. Explain CMM & optical profile projector
4. Can explain limit fit & tolerance
5. Reverse engineering of component

SL.NO	Metrology
1	Introduction to Metrology- Need of inspection- Precision and accuracy.
2	Metrology equipment – surface plate, angle plate, try square etc.
3	Checking devices – screw pitch gauge, feeler gauge, drill and centre gauges.
4	Vernier height gauge, Depth gauge- main parts, least count, Usage etc.
5	Linear measuring instruments- Vernier Caliper – main parts, least count, measuring procedure Micrometer etc. Types
6	Micrometer – main parts, Principle, Least count, Types.
7	External, Internal & Depth Micrometers- measuring procedure etc.
8	Angular measuring instruments- combination set- parts- usage etc.
9	Vernier Bevel Protractor- parts, least count, measuring procedure etc.
10	Sine bar and slip gauges- Principle, Least count, measuring procedure etc.
11	Dial indicators (Plunger, Lever) - Principle, Least count, Usage etc.

12	Bore dial and Pin hole gauges - Principle, Least count, Usage etc.
13	Checking devices – Plug, Ring & Snap gauges.
14	Checking devices – Surface Roughness testing procedures.
15	Universal measuring machine – Principle, Usage etc.
16	CMM – Principle, Parameters, Measuring procedure etc.

### LEARNING OBJECTIVES (1st Semester):

1. Polite behavior. Ability to participate in multi-disciplinary team efforts.
2. Fluency in English. Competency in letter (official) writing. Able to communicate technical information in English.
3. Communicate in written and oral and with required clarity ensuring that the information communicated is clear, concise and accurate.

Sl. No.	COMMUNICATION SKILL
1.	Informal Introduction Through Interactive Session, Body Language Or Formal Introduction
2.	Public Speaking, Presentation Skill, Resume Writing or Letter Writing, Role Plays On Verbal and Non-Verbal, Psychometric Test.
3.	Know about the GD rules discussion, HR question discussion.
4.	Life skill session, programs. Examination on skill.

### Learning Objectives (2<sup>nd</sup> Semester)

1. Interpret & use Company terminology and technical communication.
2. Making geometrical figures using drawing instruments.
3. Sectional views showing Orthographic, Isometric and Oblique projection.
4. Use of GD & T

SL.NO	ENGINEERING DRAWING
1.	Method of indicating Datum features, geometrical tolerances on drawings
2.	Indication of Machining/surface roughness symbols with Roughness grade, Roughness Value, Special treatment etc.,
3.	Study of expected surface roughness from various machining methods
4.	Types of Sections, Methods of Sectioning like Full, Half ,Offset etc.,

5.	Methods of Sectioning like Revolve, Removed, Part/Partial etc.,
6.	Conventional representation of Materials, Screw threads etc.,
7.	Conventional representation of Machine components

### Learning Objectives (2<sup>nd</sup> Semester)

1. Understand and explain different properties
2. Explain metal extraction process
3. Explain heat treatment process
4. Explain different microstructure

SL .NO	MATERIAL TECHNOLOGY
1	Introduction to materials – important properties –classification
2	Important mechanical properties
3	Ferrous metals – classification –cast irons – properties and application
4	Wrought iron - properties and applications
5	Steels –low and medium carbon steels – properties and applications
6	Steels- high carbon steels –properties and applications
7	Alloy steels- effect of alloying elements
8	Alloy steels- composition, properties and application
9	Tool & die materials – composition, properties and applications
10	Tool steels – composition, properties and applications
11	Stainless steels – composition, properties and application
12	High speed steel – composition properties and applications
13	Spring steels – composition, properties and application
14	Introduction to heat treatment processes – necessity
15	Annealing and normalizing Hardening and tempering processes
16	Cash hardening processes
17	Non-ferrous metals – properties and application
18	Aluminum& its alloys – properties and application
19	Copper & its alloys – properties and application
20	Zinc, lead and tin – properties and application
21	Plastic materials – thermoplastic & thermosetting plastic
22	Thermoplastic – trade names- properties and application
23	Thermosets – trade names- properties and application

### Learning Objectives (2<sup>nd</sup> Semester)



1. Understand the business skill in the field of marketing.
2. Understand the productivity and its factor and comparison with other countries.
3. Understand the finance management like banking.
4. Understand the health safety.
5. Understand the labour welfare and the rule regulation.
6. Understand the quality management system.

## **10. ASSESSMENT STANDARD**

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking the assessment. Due consideration shall be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitive to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude shall be considered while assessing competency.

### **10.1. ASSESSMENT GUIDELINE:**

- Criteria for assessment based on each learning outcome, will be assigned marks proportionately to its importance.
- The assessment for the theory & practical part is based on knowledge bank of questions created by trainers and approved by Examination cell (CTTC, Bhubaneswar)
- For each Individual batch, Examination cell will create unique question papers for theory part as well as practical for each examination.
- To pass the Qualification, every trainee should score a minimum of 70% cumulatively (Theory and Practical)
- Assessment comprises the following components:
  - Job carried out in labs/workshop
  - Record book/ daily diary
  - Answer sheet of assessment
  - Viva –voce
  - Progress chart
  - Attendance and punctuality

### **A. ASSESSORS:**

CTTC, Bhubaneswar faculty looking after the course “Certificate Course in Advance Machining”, also assesses the students as per guidelines set by Examination cell of CTTC, Bhubaneswar. Faculties have been trained from time to time to upgrade their skills on various aspects such as conduct of assessments, teaching methodology etc. These training are usually conducted at Xavier Institute of Management (XIMB), Bhubaneswar, Xavier Labor Relations Institute (XLRI),

Jamshedpur and other renowned Institutions/Establishments of the country.

**B. ELIGIBILITY TO APPEAR IN THE EXAM:**

Minimum 80% attendance is compulsory for the students to appear for the assessments.

**10.4. MARKING SCHEME:**

Sr. No.	Method of Assessments	Weightage (Max. marks)	Evaluator
1	Written Test	20	Trainer + Course coordinator + Examiner nominated by Examination Cell of CTTC, Bhubaneswar
2	Practical Test	40	
3	Viva-voce	10	
4	Class/Workshop/Lab performance	10	
5	Project	20	
<b>TOTAL</b>		<b>100</b>	

**C. PASSING MARKS:**

Passing criteria is based on marks obtained in attendance record, term works, assignments, practical performance, viva or oral exam, module test, practical exam and final exam.

Minimum Marks to pass practical exam – 60%

Minimum Marks to pass final exam – 70%

Minimum Marks to pass viva / oral exam – 60%

Minimum Marks to pass Project report and presentation exam – 80%

**D. RESULTS AND CERTIFICATION:**

The assessment results are backed by evidences collected by assessors. Successful trainees are awarded the certificates by CTTC, Bhubaneswar.

**10.2. FINAL ASSESSMENT**

1. There shall be an Examination paper for the each subjects.
2. The Examination for both theory and practical shall be conducted by CENTRL TOOL ROOM AND TRAINING CENTRE, BHUBANESWAR.

### SEMESTER-I

<b>MARKING PATTERN</b>		
<b>Sl. No</b>	<b>Subject</b>	<b>Maximum marks</b>
1.	Professional skills	160
2.	Professional knowledge	40
3.	Engineering Drawing	50
4.	Engineering Metrology	50
5.	Communication Skill	50
TOTAL		350

### SEMESTER-II

<b>MARKING PATTERN</b>		
<b>Sl. No</b>	<b>Subject</b>	<b>Maximum marks</b>
1.	Professional skills	160
2.	Professional knowledge	40
3.	Engineering Drawing	50
4.	Material Technology	50
5.	Project Work	50
TOTAL		350